

N.Y. Univ

Progress Report No. 10

January 1, 1965 to June 30, 1965

Effect of Pressure on Metallurgical Phenomena

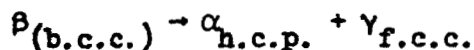
NASA Grant No. NsG-90-60

A. Transformations in the Alloy System Tl-Pb

I. Resistivity

The resistivity of thallium-lead alloys, containing up to 40 atomic % lead, were studied as a function of temperature. (See progress report #9 for more detailed description of experimental technique).

The phase diagram consists of a eutectoid reaction at 180°C, with a eutectoid composition of 4.0 atomic % lead. The reaction may be written as follows:



The horizontal at 180°C extends from 3-10 atomic per cent lead.

Isotherms of resistivity vs. composition were drawn. Changes in slope of these curves yielded points on the h.c.p./h.c.p. + f.c.c. and the h.c.p. + f.c.c./f.c.c. curves.

The h.c.p./h.c.p. + f.c.c. curve starts at 3% at 180°C and decreases to about 2% at room temperature.

The $\alpha + \gamma/\gamma$ curve starts at about 10% at 180°C and increases to about 12.5% lead at room temperature.

Isotherms were also drawn at temperatures above 180°C. They indicate that the b.c.c./b.c.c. + f.c.c. and the b.c.c. + f.c.c./f.c.c. curves both have steep, positive, but finite slopes.

CFSTI PRICE(S) \$

Hard copy (HC)

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653 July 65

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(PAGES)

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65-29173

Resistivity runs of 4.4% Pb and 11.0% Pb showed changes in slope above the eutectoid temperature. These points correspond to the passing through the b.c.c./b.c.c. + f.c.c. and the b.c.c. + f.c.c./f.c.c. boundaries respectively.

II. X-ray Diffraction

Powder patterns taken at room temperature showed that the α form is stable up to about 2 atomic % lead. Between 2 and 12.5 atomic % lead, a two-phase mixture of α and γ is stable. At still greater lead content, only the f.c.c. γ form is stable.

The values of 2% and 12.5% were arrived at by plotting lattice parameter vs. composition, which extended from the single phase region into the 2-phase region. The solubility limit was taken as the intersection of the two curves, one curve from each composition region.

High temperature X-ray work is yet to be completed.

Section B. Irving B. Cadoff

HIGH PRESSURE AND TEMPERATURE EFFECT ON SnTe

I. Calibration

The high pressure apparatus has been recalibrated using the new cell design described previously. The calibration is performed by measuring the resistivity of Tl, Bi and Ce against the pressure gauge indicated on machine. At the phase transformation the resistivity changes abruptly. The transformation pressure of Tl, Bi and Ce are well established at 36.7, 27(Bi II), 25.4(Bi I) and 7 k bar respectively. The recycling transformations were also measured in order to correspond to data taken on the second cycle. The calibration curve is an "S" type curve. The calibration points have been double checked and have a variation within 200 psi.

II. SnTe

The resistivity of SnTe was measured at constant pressure as a function of temperature and at constant temperature as a function of pressure. These data yielded a Pressure - Temperature phase diagram for the solid phase of SnTe. A new solid phase SnTe (III) was found at high temperature and pressure. Both the high pressure phases SnTe (II) and SnTe (III) are not retained at room temperature and atmospheric pressure. This is shown by the return of the resistivity to its initial value upon release of the pressure. X-ray data confirm it and show no new phase after release of pressure. It will be interesting to find the structure of SnTe (III) which can be determined from a high temperature high pressure X-ray

pattern. Such a high temperature high pressure X-ray machine is available only in two places in the United States. We have contacted Dr. W. Field of Air Force Cambridge Research Laboratory and requested the use of his machine to make this determination.